Effects of ICRF and LHRF Power on SOL Density Profiles in Alcator C-Mod

ICRF and LHRF systems on Alcator C-Mod

Motivation and Background

- SOL density profiles dictate antenna-plasma coupling
- ICRF is sensitive to mm-evanescent layer, so small changes in density profiles are small for ICRF coupling
- LHRF is sensitive to mm-evanescent layer, so small changes in density profiles are small for LHRF coupling

Frequency
- 4.6 GHz
- 80–80.5 MHz
- 40–80 MHz

Reflectometer
- 1.0 GHz
- 4.6 GHz
- 80 MHz

Antenna
- 1.4 x 16 modules
- 2 x 2 – 3 x 4 modules

Phasing
- x from 1.5 to 3
- Fixed
- Variable

Future Work will explore possible poloidal asymmetries in SOL density profiles

ICRF Convective Cells

LH Induced Vortex

Conclusions

- A reflectometer has been built to measure the SOL density profiles due to ICRF or LH power
- LH power can significantly decrease density in front of LH launcher, creating significant high-reflection coefficients
- Effects of LH on SOL density profiles is strong for \( n_e > 1 \times 10^{20} \text{m}^{-3} \)
- ICRF system to create only small changes in front of LH launcher
- Future work includes studying poloidal variations of ICRF and LH on SOL density profiles and measuring near the new field-aligned ICRF antenna

Effects of ICRF and LHRF Power on SOL Density Profiles

ICRF power does not change SOL density profiles except in far SOL

SOL reflectometer on Alcator C-Mod

Effects of LHRF power on SOL density profiles are large at high densities

Main result: LHRF power decreases density in front of LH launcher

Sample density profiles at \( n_e = 0.8 \times 10^{20} \text{m}^{-3} \)

- Effects of LH is shown for 3 line-averaged densities. OH (exp) and LH (exp) is shown on right.
- The \( n_e = 0.8 \times 10^{20} \text{m}^{-3} \) case is shown on the left.

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New field-aligned 4-strap ICRF antenna (and ICRF SOL reflectometer)

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